(2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

In this draft EIS, DOE applied the environmental justice guidance to determine whether there could be any disproportionately high and adverse human health or environmental impacts on minority or low-income populations surrounding the Moab site as a result of the implementation of the on-site disposal alternative. Environmental justice concerns were analyzed through an assessment of the impacts reported. Although no high and adverse impacts were identified, DOE considered whether minority or low-income populations would be disproportionately affected by the alternatives.

An assessment of the census data found that, within the 50-mile area around the Moab site, less than 1 percent of the population had a household income below $18,244, the poverty level for a family of four.

DOE has identified no high and adverse impacts, and there are no minority or low-income populations who would be disproportionately affected by implementation of the on-site disposal alternative.

4.2 Off-Site Disposal (Klondike Flats Site)

The Klondike Flats site is the closest of the alternative disposal sites to the Moab site (approximately 18 miles to the north). This section discusses the short-term and long-term impacts associated with the first of three off-site disposal alternatives. The impacts are based on the proposed actions described in Section 2.2 and the affected environment described in Section 3.2 of this EIS. This alternative may result in the following impacts:

- Impacts at the Moab site
- Impacts at the Klondike Flats site
- Transportation impacts associated with moving tailings from the Moab site to the Klondike Flats site
- Monitoring and maintenance impacts at the Klondike Flats site

The combined impacts that may result from these activities are then summarized for each assessment area (e.g., Geology and Soils) at the end of each subsection. For many activities, impacts at the Moab site would not differ significantly from those described in Section 4.1. Impacts of characterization and remediation of vicinity properties would be the same as those described in Section 4.1. Transportation impacts would vary, depending upon the transportation mode (truck, rail, or slurry pipeline). Vicinity property materials would be co-transported from the Moab site to the Klondike Flats site. Therefore, impacts associated with transporting vicinity property materials are not addressed separately. Impacts associated with borrow areas are addressed collectively in Section 4.5 and are therefore not addressed in this section.

4.2.1. Geology and Soils

Monitoring and maintenance activities would not adversely affect geology and soils. Therefore, these activities are not addressed further in this section.

4.2.1.1 Construction and Operations Impacts at the Moab Site

The geology and impacts at the Moab site due to surface and ground water remediation would be the same as those described for the on-site disposal alternative in Section 4.1.1.1. The soil impacts at the Moab site would be similar to those described in Section 4.1.1.1, however, the approximately 234,000 tons (173, 000 yd^3) of excavated off-pile contaminated site soil would be shipped off-site rather than relocated to the tailings pile. Excavation and backfilling of the tailings pile and the estimated 420,000 yd^3 (2 ft) of contaminated subpile soil that would occur under the off-site disposal alternative would increase the potential for short-term soil erosion at the Moab site.

4.2.1.2 Construction and Operations Impacts at the Klondike Flats Site

Geology

Earthquake risks and seismic activity at the site are low. No hazards to disposal cell stability, such as landslides, slumping, or rock falls, are known to exist. Identified geological resources underlying Klondike Flats are too deep for economical exploitation and therefore would not be affected by the Klondike Flats disposal alternative.

Soils

The primary impact to soils would be the excavation to construct the new disposal cell; this impact would be short term. In addition, approximately 2.2 million yd^3 of borrow soil and other borrow material would be excavated for use at the disposal cell site and Moab site. The maximum area of disturbance to the cell construction area would be 435 acres. The short-term erosion potential and erosion mitigation measures would be identical to those described for the on-site disposal alternative. In addition, UMTRA Project experience has shown that after construction of low-permeability layers within a disposal cell, soils adjacent to the cell are subject to increased long-term erosion due to runoff from the cell. The potential for this long-term erosion to occur would be reduced through the proposed design enhancements along the edges of the cell. Construction of the disposal cell would not result in soil subsidence impacts because construction of the cell would involve removing soils to bedrock.

4.2.1.3 Construction and Operations Impacts Associated With Transportation

Table 4–20 summarizes the areal extent of disturbed soils at the Moab and Klondike Flats sites, including the extent of on-site soils disturbance for each transportation mode (see Section 2.2.7.3). The table also shows the additional disturbance between the Moab site and the Klondike Flats site for each mode. Off-site disturbances would range from 40 to 85 acres; the slurry pipeline would involve the greatest disturbance.

Table 4–20. Summary of Short-Term Soil Impacts—Klondike Flats Off-Site Disposal Alternative

Soil Disturbance Location or Source	Area of Soil Disturbance (acres)
Moab Site (on site)	439
Klondike Flats (on-site; including transportation disturbances)	
Truck transportation	435
Rail transportation	420
Slurry pipeline transportation	435
Moab to Klondike Flats (off site; exclusive of on site)	
Truck transportation	40
Rail transportation	69
Slurry pipeline transportation	85

4.2.1.4 Impacts from All Sources

Under the Klondike Flats disposal alternative, impacts to soils would be short term and would occur from excavation and other disturbances to soils associated with surface remediation activities at the Moab site; construction of the disposal cell, cell access roads and staging areas; and from construction of infrastructure to support the selected transportation method. Table 4–20 summarizes the areal extent of disturbed soils at all locations under the Klondike Flats off-site disposal alternative. The potential for long-term erosion of soils adjacent to the disposal cell exists but would be controlled by construction design enhancements.

4.2.2 Air Quality

Monitoring and maintenance activities would not adversely affect air quality. Therefore, these activities are not addressed further in this section.

4.2.2.1 Construction and Operations Impacts at the Moab Site

During remediation activities at the Moab site, heavy-duty diesel equipment such as graders, scrapers, and dozers would emit pollutants and fugitive dust. Emission of fugitive dust would be minimized by use of control measures, such as applying water or chemicals and covering open-bodied trucks. As shown in Table 4–21, concentrations of criteria pollutants from the Moab site emissions would be below the primary and secondary NAAQS in 40 CFR 50; concentrations estimated for the truck, rail, or slurry pipeline options would all be about the same. The estimated concentrations shown in Table 4–21 and Table 4–22 were derived by applying tailpipe emission factors provided in *Compilation of Air Pollutant Emission Factors* (EPA 2000) to the estimated construction fleet composition and duration of construction operations.

4.2.2.2 Construction and Operations Impacts at the Klondike Flats Site

During construction activities at the Klondike Flats site, heavy-duty diesel equipment such as graders, scrapers, and dozers would emit pollutants and fugitive dust. Emission of fugitive dust would be minimized by use of control measures, such as applying water or chemicals and covering open truck beds. As shown in Table 4–22, concentrations of criteria pollutants from the Klondike Flats site emissions would be below the primary and secondary NAAQS in 40 CFR 50; concentrations estimated for the truck, rail, or slurry pipeline options would all be about the same. As noted in Section 4.1.2.1, Utah PSD regulations provide that concentrations of PM_{10} attributable to the increases in emissions from construction or other temporary emission-related activities shall be excluded in determining compliance with the maximum allowable increase.

Table 4–21. Criteria Pollutant Concentrations at the Moab Site

Pollutant	Averaging Period	Standard (µg/m^3)	Concentration from Emissions (µg/m^3)
Carbon monoxide	1-hour	40,000	40
	8-hour	10,000	28
Nitrogen dioxide	Annual	100	9.1
Sulfur dioxide	Annual	80	0.90
	24-hour	365	4.5
	3-hour	1,300	10
PM_{10} [a]	Annual	50	3.2
	24-hour	150	16

[a]PM_{10} includes fugitive dust emissions from construction activities.
µg/m^3 = micrograms per cubic meter.

Table 4–22. Criteria Pollutant Concentrations at the Klondike Flats Site

Pollutant	Averaging Period	Standard (µg/m^3)	Concentration from Emissions (µg/m^3)
Carbon monoxide	1-hour	40,000	53
	8-hour	10,000	37
Nitrogen dioxide	Annual	100	12
Sulfur dioxide	Annual	80	1.3
	24-hour	365	6.3
	3-hour	1,300	14
PM_{10} [a]	Annual	50	3.6
	24-hour	150	18

[a]PM_{10} includes fugitive dust emissions from construction activities.
µg/m^3 = micrograms per cubic meter.

4.2.2.3 Construction and Operations Impacts Related to Transportation

The air quality impacts of transportation under the Klondike Flats disposal alternative are included in Section 4.2.15, "Human Health."

4.2.2.4 Impacts from All Sources

Emissions of criteria air pollutants, including carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10}, would occur at the Moab site, Klondike Flats site, and vicinity properties due to the operation of heavy construction equipment and ground water remediation equipment. No criteria air pollutant emission concentrations at the Klondike Flats site, where concentrations would be expected to be highest, would exceed NAAQS.

4.2.3 Ground Water

Monitoring and maintenance activities would not result in adverse impacts to ground water. Therefore, these activities are not assessed further in this section.

4.2.3.1 Construction and Operations Impacts at the Moab Site

Short-term impacts to ground water would be similar to those described under the on-site disposal alternative. Until construction was completed and the tailings pile was removed from the site, seepage contributed by pore fluids from the base of tailings pile would be expected to contribute a continuous source of 1,100 mg/L ammonia to the ground water system. However, if the pile were removed, no long-term potential for natural subsidence or for seepage of tailings fluids and the salt layer, as described in Section 4.1.3, from the tailings pile to the ground water would exist. The seepage rate from the tailings as a function of time and ammonia concentration is summarized in Table 4–23. In addition, the potential for increasing ammonia concentrations in surface water as a result of a flood would be eliminated.

Table 4–23. Assumptions for Liquid Drainage and Ammonia Concentrations From the Tailings Pile Under the Off-Site Disposal Alternative

Parameter	Value
Infiltration rate	1×10^{-7} cm/s
Gravity drainage	Constant rate: 8 gpm
Transient drainage	Rate would decay from 12 gpm at present to 0 gpm when construction ended
Initial ammonia concentration seepage from base of tailings pile	1,100 mg/L during construction
Breakthrough ammonia concentration from upper salt layer	Not applicable once tailings were removed
Arrival time	Not applicable once tailings were removed
Final concentration	0 mg/L once tailings were removed
Exit time	Not applicable once tailings were removed

gpm = gallons per minute; mg/L = milligrams per liter; cm/s = centimeters per second

Modeling results, presented in Figure 4–7, indicate that most of the ammonia flux from the brine layer and the legacy plume in the alluvial aquifer would flush naturally to the river in approximately 60 to 80 years. At the end of this period, concentrations would decline more rapidly under the off-site disposal alternative than under the No Action alternative or the on-site disposal alternative, because the continuing source of ammonia seeping from the base of the tailings pile would no longer be present. Ground water concentrations would continue to decline until background levels were reached. Predicted concentrations plotted in Figure 4–7 represent the maximum ammonia-N concentrations from a series of observations located along a transect parallel to the Colorado River downgradient from the toe of the tailings pile along a flow path near the center of the plume.

Modeling results indicate that ammonia concentrations in ground water near the bank of the Colorado River would be expected to decline from the current 500 to 1,000 mg/L to a maximum of approximately 3 mg/L in 75 years and reach background concentrations in approximately 150 years. Concentrations at 75 years are illustrated in Figure 4–8.

4.2.3.2 Construction and Operations Impacts at the Klondike Flats Site

There would be no anticipated effects on regional or local ground water quality resulting from a proposed disposal cell in the Klondike Flats area; the uppermost aquifer (Dakota Sandstone or Cedar Mountain Formation) is approximately 400 to 500 ft below land surface. The Dakota Sandstone is separated from the surface by a thick section of relatively impermeable Mancos Shale that acts as an aquitard to inhibit ground water flow to deeper stratigraphic units. A first-order estimate of travel time for any water seeping from the cell to migrate through the Mancos Shale and reach the uppermost aquifer is over 25,000 years. This estimate is based on a typical hydraulic conductivity value of 1.0×10^{-9} centimeters per second (cm/s) for marine shale (Freeze and Cherry 1979) and a porosity of 0.06 (Morris and Johnson 1967). This travel time estimate would be verified by site characterization if this site were selected as the off-site alternative. The Ferron Sandstone Member is approximately 200 to 300 ft above the base of the Mancos Shale but is not considered a water-bearing unit. The first significant regional ground water resource is in the Navajo Sandstone, approximately 1,500 to 2,000 ft below land surface. This ground water resource would not be affected by a proposed disposal facility in this area. The areal extent and duration of potential impacts would be limited or nonexistent. There would be no beneficial or adverse effects on ground water if the proposed disposal cell were located at this site. There are no sole-source aquifers in the area within reasonable range of potential impact from the proposed disposal cell.

There would be no anticipated present or future effects on ground water use in the area because there is very little current use and none in the immediate area of the proposed disposal cell.

The compliance strategy for ground water protection would be to meet maximum concentration limits or background levels in the uppermost aquifer, which would be ground water in the Dakota Sandstone or Cedar Mountain Formation. Implementation of this strategy would be enhanced by hydrogeologic isolation (from the 400 to 500 ft of Mancos Shale) and disposal cell design.

4.2.3.3 Construction and Operations Impacts Related to Transportation

In areas that may be affected by the transportation corridors, depth to ground water in the uppermost aquifer varies from less than 100 ft near the Moab site to more than 700 ft near the Klondike Flats site. Therefore, no adverse impacts to ground water as a result of transportation modes are expected.

4.2.3.4 Impacts from All Sources

Ground water at the Moab site would not be adversely affected. Active remediation of ground water influencing surface water would result in reducing the adverse impact to surface water. No adverse impacts would occur to ground water at the Klondike Flats site or to ground water in the transportation corridors.

4.2.4 Surface Water

Because no perennial surface waters are present at the Klondike Flats site, there would be no short-term or long-term impacts to surface water as a result of construction or operations. Likewise, no perennial surface waters are present in the transportation corridors, resulting in no

adverse impacts. Monitoring and maintenance activities would not result in adverse impacts at the Klondike Flats site. Therefore, these activities are not assessed further in this section.

4.2.4.1 Construction and Operations Impacts at the Moab Site

Impacts to surface water would be similar to those described under the on-site disposal alternative (Section 4.1.4.1). In the short term, sediment runoff would be controlled during construction and operations activities. Also in the short term, site-related contaminant concentrations affecting the Colorado River would be reduced through implementation of interim actions. Within 5 years of implementing active ground water remediation, contaminant concentrations in surface water would meet applicable surface water criteria. Surface water monitoring would continue after completion of active remediation to verify that contaminant concentrations in surface water were below surface water criteria.

Storm water management during site reclamation would include berms between the site operational areas and the Colorado River and Moab Wash to ensure that the site was not inundated from a flood up to the magnitude associated with a 25-year return interval. If a flood of greater magnitude than this occurred, there would be a potential for tailings to be transported off the site and into the Colorado River and Moab Wash. During a flood greater than the 25-year return interval, alternatives that include on-site drying of tailings materials (i.e., off-site disposal using truck or rail haul) would have the potential for supplying a greater amount of tailings to flood waters than alternatives that do not include on-site drying (i.e., off-site disposal using slurry pipeline or on-site disposal).

4.2.5 Floodplains/Wetlands

Because the Klondike Flats site has no known floodplains or wetlands, no adverse impacts would be expected as a result of monitoring and maintenance or construction and operations activities. A more detailed discussion of impacts to floodplains and wetlands is included in Appendix F.

4.2.5.1 Construction and Operations Impacts at the Moab Site

Impacts at the Moab site under this alternative would be similar to those described under the on-site disposal alternative (Section 4.1.5.1). Impacts due to rechanneling Moab Wash would not occur, but the meanders that would be added to Moab Wash in its current location would result in its carrying less sediment to the river than it does now. The buried riprap wall would not be installed, so no impacts would result. Short-term impacts to the floodplain would result from construction of tailings processing areas; these areas would be removed after remediation.

4.2.5.2 Construction and Operations Impacts Related to Transportation

Because ephemeral intermittent washes with riparian resources are located near Klondike Flats, the potential for short-term impacts due to construction of transportation routes exists. Impacts would be minimized by avoiding these areas wherever possible and implementing measures to restrict sediment or water runoff from the roads. No long-term impacts would be expected.

4.2.5.3 Impacts from All Sources

At the Moab site, there would be short-term adverse impacts to wetlands and floodplains, and long-term impacts to floodplains associated with remediation and construction activities. Long-term effects associated with adding meanders to Moab Wash would be expected, but they would be beneficial.

4.2.6 Aquatic Ecology

Because no perennial surface waters are present, no adverse impacts to aquatic communities or receptors would occur as a result of construction and operations or monitoring and maintenance at the Klondike Flats site. Therefore, these activities are not discussed further in this section.

4.2.6.1 Construction and Operations Impacts at the Moab Site

Impacts to aquatic biota and habitats at the Moab site would be very similar to those described under the on-site disposal alternative. As described in Chapter 2.0, it is assumed that the same amount of physical disturbance would occur at the Moab site regardless of the disposal option. Chemical and radiological impacts to aquatic resources would be similar to those under the on-site disposal alternative in the short term. The annual use of 235 to 730 acre-feet (depending on transportation mode) of nonpotable Colorado River water would be within DOE's authorized river water use rights but would exceed the 100-acre-foot annual limit set by USF&WS as protective. This unavoidable impact would be mitigated through negotiated water depletion payments. In the long term, removal of the tailings pile combined with active ground water remediation would decrease the time that the contaminants from the disposal cell would affect aquatic resources.

4.2.6.2 Construction and Operations Impacts Related to Transportation

Because no perennial surface waters are present along the transportation corridor between the Moab site and the Klondike Flats site, no adverse effects to aquatic receptors would occur as a result of transportation at the Klondike Flats site. Therefore, transportation-related impacts are not discussed further.

4.2.6.3 Impacts from All Sources

Overall impacts to aquatic ecological resources under the Klondike Flats off-site disposal alternative would include short-term impacts (1) from construction activities along the edge of the Colorado River at the Moab site, (2) from construction of transportation infrastructure across ephemeral surface water channels, and (3) potentially from any transportation spills. These short-term impacts would not occur once the disposal cell construction and the transportation of tailings were complete. No long-term adverse impacts to aquatic resources are expected.

4.2.7 Terrestrial Ecology

Under the off-site disposal alternative, the physical, chemical, and radiological impacts to terrestrial species and habitats associated with construction and operations at the Moab site would be similar to those described for on-site disposal (Section 4.1.7). Appendix A1,

"Biological Assessment," presents a detailed discussion of federally listed species that would be affected in the Klondike Flats area.

4.2.7.1 Construction and Operations Impacts at the Klondike Flats Site

Construction of a disposal cell and ancillary support facilities would disturb up to 435 acres at the Klondike Flats site in the disposal cell area. The impacts of physical disturbance would include the short-term loss of cover, foraging, and breeding habitat in construction areas. In the long term, the area occupied by the proposed disposal cell would result in a permanent loss of habitat. Species with small home ranges would be displaced. However, species with larger home ranges are not anticipated to be adversely affected.

The endangered black-footed ferret (*Mustela nigripes*) is the only federally listed species that could potentially be affected by habitat disturbance resulting from construction of a disposal cell. The white-tailed prairie dog (*Cynomys leucurus*), upon which the black-footed ferret depends, is the only species currently in review for federal listing that could be so affected. All black-footed ferrets currently in the wild are believed to be the result of a federal reintroduction program. It is highly unlikely that the black-footed ferrets reintroduced in Uinta and Duchesne counties in 1999 or their offspring could occur on or in the vicinity of the Klondike Flats disposal site, although the UDWR (2003) reported an unconfirmed sighting in the area in 1989. Consequently, impacts from construction to the black-footed ferret would not be anticipated.

Surveys for white-tailed prairie dogs have been conducted at the Klondike Flats site (BLM 1995). At that time, it was determined that all of the colonies were relatively small and isolated, such that they would not support black-footed ferrets. Prior to development of the Klondike Flats disposal site, the area would be surveyed and the potential effects to white-tailed prairie dogs evaluated. In addition, the potential of such colonies to support black-footed ferrets would also be evaluated simultaneously.

Noise due to construction and operations could have an adverse effect on terrestrial wildlife. At the Klondike Flats site, noise would be generated by construction equipment and material transfer operations. It is estimated that the maximum noise levels that would be generated when all equipment was operating would be approximately 95 dBA measured at 49 ft. This noise level would attenuate over a distance of approximately 6 miles until it reached the quiet desert background level of approximately 30 dBA.

Noise can affect terrestrial organisms by causing physiological changes or behavioral modifications, including nest abandonment. It can also disrupt communication and defense systems. Any of the species that may be present at the Klondike Flats site could be affected by the noise associated with construction and operations. Some of these, such as burrowing owls and prairie dogs, are frequently found close to human activities and may thus be more likely to habituate to noise above background levels.

The Utah Gap Analysis (UDWR 1999) indicates that potential high-quality bald eagle wintering habitat exists throughout many of the project areas. The bald eagle is the only federally listed species in the vicinity of the Klondike Flats site that could be affected by noise from site operations. However, it is not known to nest or night roost in the area, nor is it commonly seen in the area, and it would therefore be unlikely to be affected.

Other effects of human presence, including night lighting, also would reduce the overall habitat value of the area. As with noise, some species become habituated to human presence, but others, such as deer or pronghorn antelope, could avoid the site during human activities. The Klondike Flats site is surrounded by many square miles of similar habitat. Therefore, individuals that avoided the vicinity of construction activities would not be forced into less desirable habitat.

Because the effects of noise, supplemental lighting, and human presence could be greater at night than during the day, double-shift operations would likely have greater impact than single-shift operations. The effects of noise, supplemental lighting, and human presence could be mitigated by limiting the amount of light off the site, minimizing activities at the periphery of the site, and limiting especially loud activities to daylight hours and to seasons when the effects on biota would be reduced. There would not likely be chemical impacts at the Klondike Flats site. Accidental spills of diesel, oil, or other materials would be quickly controlled and mitigated.

Other species of interest, if present, that could be affected by construction of a disposal cell and the associated types of disturbance discussed above, include the burrowing owl, Swainson's hawk, ferruginous hawk, and peregrine falcon.

Impacts of physical disturbance could be avoided or minimized in several ways. The most important action would be to conduct site-specific investigations prior to any development activities at the site to determine the presence of any species of concern. Additional actions would include minimizing site disturbance to the extent practical, revegetating disturbed lands and the cover cap after cleanup was completed, and scheduling ground-clearing activities during periods that would not disturb nesting migratory birds.

4.2.7.2 Impacts of Transportation

The effects to terrestrial species and habitats of transporting the tailings to the Klondike Flats site would depend on the transportation option selected. Truck transport would increase collision mortality and noise, rail transport would increase noise and require greater land development at the Klondike Flats site, and a slurry pipeline would likely disrupt more habitat along the pipeline corridor.

At the Klondike Flats site, much of the cover and radon barrier borrow materials could be obtained from borrow sites relatively near the disposal site, and much of the transport of borrow materials would occur on lower-speed access roads than US-191. This could translate into a lower rate of wildlife-vehicle collisions and less noise due to truck transport of borrow materials compared to transporting the materials from more distant borrow sites on higher-speed access roads.

Truck Transportation Option

Truck transportation of tailings materials from the Moab site to the Klondike Flats site would increase the amount of truck traffic on US-191 north of Moab (Section 4.2.16). This increase in traffic would likely lead to an increase in traffic-related wildlife mortalities and an increase in the average noise levels in the vicinity of the highway.

Bighorn sheep are occasionally observed in the vicinity of US-191, and there have been traffic-related mortalities in the area. Other species potentially affected include mule deer and

pronghorn antelope. Small mammals, reptiles, and possibly birds would also suffer increased highway mortality rates. However, it is unlikely that the regional population of any wildlife species would be significantly affected by this increased traffic mortality rate.

The bald eagle is the only federally listed species that could incur an increase in traffic-related mortality. The Utah Gap Analysis (UDWR 1999) indicates that potential high-quality bald eagle wintering habitat exists throughout many of the project areas. Bald eagles could be found temporarily and infrequently using such areas when there are opportunities to feed on carrion, such as in big-game wintering areas or in prairie dog colonies. Therefore, it is possible that if traffic-related wildlife mortality increased due to the project, an increased number of eagles could be hit on highways. However, without data on this relationship, it is reasonable to assume that the number of eagles hit on highways would be proportional to the number of carrion available. The increase in the number of traffic-related wildlife mortalities is expected to be small. Consequently, the potential increase in associated eagle deaths is also expected to be small.

The increased truck traffic along US-191 resulting from transport of tailings from the Moab site to the Klondike Flats site would likely increase ambient noise levels by approximately 5 dB (measured at 49 ft). However, no adverse effect to terrestrial wildlife is anticipated.

The primary federally listed species that could be affected by this increased traffic noise would be the Mexican spotted owl. Data provided by the UDWR (2003) indicated that there were no occurrences of the Mexican spotted owl in any of the project areas. However, habitat models (BLM 2003) indicate that potential habitat areas may exist in the canyons near US-191 over the first 7 miles north from the Moab tailings pile. Nonetheless, these models are primarily based on physical and topographic features and do not consider vegetation requirements. Mexican spotted owls nest, roost, and forage in an array of different community types, but mixed-conifer forests dominated by Douglas fir and/or white fir are most common (USF&WS 1995). However, they may also nest, but less frequently so, in arid, rocky, mostly unvegetated canyons (Romin 2004). Although there are no forested areas in the vicinity of US-191 north of Moab, there are arid canyons that largely or altogether lack forest-type vegetation. Thus, it is unlikely but possible that spotted owls occur in the canyons near US-191 over the first 7 miles north of the Moab site. If present, the species could be disturbed by noise from increased truck traffic. The area around this section of transportation corridor is a popular recreation area, with heavy use by off-highway vehicles and mountain bikes. Although the increase in truck traffic noise could be detectable up to several miles from the highway, the existing off-road vehicle noise and associated human presence would likely have a greater and more direct impact on the owls.

The potential for impacts to terrestrial wildlife from truck transportation of tailings would be greater in the evening or at night than during the day. Therefore, the impacts of double-shift operations would probably be greater than those of single-shift operations. In either case, such impacts would be of relatively short duration and would cease once the transfer of materials to the disposal cell was completed.

Rail Transportation Option

Rail transportation of tailings from the Moab site to the Klondike Flats site would result in less frequent but potentially higher intermittent noise and ground vibration levels (Section 4.2.10) compared to the truck transportation option. As with truck traffic, this would probably not

adversely affect Mexican spotted owls in the vicinity of the rail corridor. Other wildlife species could be sensitive to noise from the rail system, but because of the degree of off-road recreational activity in the area, most wildlife is probably somewhat habituated to human presence and noise. The potential collision-mortality rate would be lower using rail transport compared to the truck transportation option.

Development of the rail infrastructure would disturb slightly more land than either of the other two transportation options. Most of this would occur very near or within the Klondike Flats site boundaries and would not result in increased habitat fragmentation.

The effects of noise on wildlife would be of relatively short duration and would cease at the completion of tailings transport. Because of the poor soils and arid climate, reclamation of the rail infrastructure areas, if pursued, would be slow, resulting in longer-term effects.

Slurry Pipeline Option

Use of a slurry pipeline system to transport tailings from the Moab site to the Klondike Flats site would disturb less habitat at the Klondike Flats site than either of the other transport options. However, this option would increase the amount of potential habitat disturbance away from the disposal site along the transportation corridor.

Construction of the pipeline would disturb some habitat along the route; however, much of this habitat occurs in previously disturbed corridors.

Installation of the pipeline system could disturb species along the transportation corridor such as the Mexican spotted owl, white-tailed prairie dog, black-footed ferret, and species of ground-nesting migratory birds, if present. Site-specific investigations would be conducted prior to pipeline construction to identify any populations of these species. If present, potential impacts could be mitigated by adjusting the location of the pipeline route, or constructing the pipeline during periods of the year that would not disrupt nesting of spotted owls or migratory birds. Operation of the pipeline would not be expected to have any adverse effects on wildlife species or habitats.

4.2.7.3 Monitoring and Maintenance Impacts

Routine post-closure monitoring and maintenance of a disposal cell at the Klondike Flats site would not be expected to have any impacts to terrestrial species or habitats. In the event that major corrective actions were needed, some vegetation recovering on and around the disposal site could be disturbed.

4.2.7.4 Impacts from All Sources

Overall impacts to terrestrial ecological resources from the Klondike Flats off-site disposal alternative would include approximately 50 acres of tamarisk habitat lost at the Moab site (the rest of the site is considered to have zero habitat quality), a maximum of approximately 690 acres of desert habitat at the borrow sites, 420 to 435 acres for development of the disposal cell, and varying additional acreage depending on the mode of transportation.

Total maximum habitat disturbance for the truck or rail transport options from all activities (Moab site, borrow areas, transportation, and Klondike Flats site) would be approximately 1,200–1,245 acres. If the slurry pipeline option were selected, 85 acres would be disturbed for the pipeline corridor and 24 for support roads, bringing the total maximum disturbance from all activities to approximately 1,385 acres.

An additional amount of habitat would be lost at the commercial quarry sites for sand, gravel, and riprap. There would be a slight decrease in habitat value near US-191 if the truck transport option were selected because of increased truck traffic required to haul tailings materials, and there would be a slight increase in traffic-related wildlife mortalities. The rail transport option would result in slightly higher average noise levels near the rail corridor. Impacts of borrow material haulage would be less than for the on-site disposal alternative because the radon barrier and cover materials would be available near the disposal cell site, and haulage of these materials at highway speeds on US-191 would not be required.

4.2.8 Land Use

4.2.8.1 Construction and Operations Impacts at the Moab Site

Impacts to land use would include potential changes to existing land use at the Moab site or at nearby properties. Land use impacts of construction and operations at the Moab site with final disposal at Klondike Flats would be primarily short-term impacts. Construction and operations at the Moab site, which is currently under federal ownership and control, would not alter existing land use at the site. Noise and vibrations that could occur as a result of these activities would be unlikely to travel off the site and thus would be unlikely to affect the use of adjacent or nearby recreational areas (see Section 4.2.10).

Some long-term land use impacts would occur at the Moab site. Following removal of the tailings, ground water contamination would remain beneath the site, and DOE would retain some land for a water treatment facility that would operate until surface water goals were met. Property designated for this facility would likely be in federal ownership for 75 years, creating a loss of that acreage for beneficial land use during this period by other government or private owners and potential interference with other uses of the site.

As discussed in Section 1.4.5, release of portions of the site for future uses would depend on the success of site remediation. DOE's ultimate goal would be to remediate to unrestricted surface use standards. However, DOE would defer its decisions on the release and future use of the Moab site pending an evaluation of the success of surface and ground water remediation.

The long-term commitment of the Moab site for ground water remediation would conflict with Grand County land use planning that designates the site as a Specially Planned Area during remediation activities according to County Ordinance 346, but that envisions future land uses that would allow for low-density residential uses upon completion of remediation.

4.2.8.2 Construction and Operations Impacts at the Klondike Flats Site

Impacts to land use would include potential changes to existing land use at the affected site or at nearby properties. The land selected for the Klondike Flats site is currently administered by BLM. The approximately 435 acres needed for the cell construction area would be withdrawn from BLM administration and transferred to DOE in perpetuity. All surface and subsurface land uses would be vested with DOE.

The Klondike Flats site is currently part of the Big Flat grazing allotment, which is under permit until 2013. This permit would be vacated, and there would be a loss of 0.4 percent of the allotment's grazing rights for the current permittee. The Klondike Flats site is also available for oil and gas and mineral leasing. A disposal cell in this location would create a long-term loss of all grazing rights and oil and gas and mineral extraction in perpetuity. This would create a long-term loss of revenue for any surface or subsurface permits or leases on the site.

All three options for transportation to the Klondike Flats site would require a permanent access road and land for other transportation modes and the associated infrastructure. About 40 acres of land would be required for the truck haul option transportation infrastructure, including a new overpass to exit US-191. For a rail haul option, approximately 69 additional acres would be needed to construct new rail spurs, a transfer station, and haul roads. Wherever possible, a slurry pipeline would be constructed in the existing pipeline right-of-way or along the US-191 right-of-way. However, approximately 24 acres would be disturbed for a transfer station. For a slurry pipeline, some truck haul roads would still be needed, and the associated impacts would still exist because not all materials could be transported by slurry pipeline to the site for final disposal and must be transported by other means. Land disturbance for the slurry pipeline would be short term because the property allocated for such use would be reclaimed once remediation of the Moab site was complete and the disposal cell was capped.

Regardless of the mode of transportation, a new public access road would be constructed parallel to CR-138 (Blue Hills Road) to facilitate public and recreational traffic south of the site. It is likely that the new access road would be constructed in the existing county right-of-way, and no new land use impacts would occur. The location and length of the permanent access road would vary depending on the transportation mode and would require approximately 7,000 ft of right-of-way across a southern section of the site, which is currently administered by the State of Utah.

4.2.8.3 Construction and Operations Impacts Related to Transportation

Under the truck haul option, trucks would use the existing highway between the Moab site and the Klondike Flats site. As noted, a new public access road would be constructed to the site. There is an existing rail line between Moab and a location near Klondike Flats. Other than the construction and operation of a rail spur from this line to the Klondike Flats site, there would be no additional land use impacts as a result of the rail haul option.

Noise and vibration would occur above background levels as a result of transporting the tailings by truck or rail and could temporarily disturb residents, businesses, and recreational users along the travel routes (see Section 4.2.10) and temporarily affect current uses of those properties. Traffic disruptions could occur as a result of increased truck traffic and adversely affect residents, businesses, and recreational users along the travel routes (see Section 4.2.16).

The slurry pipeline route from the Moab site to the Klondike Flats site would be 18.8 miles, all within lands administered by BLM. The pipeline would be located in an existing right-of-way to the extent possible, or in a right-of-way parallel to the existing right-of-way. Use of an existing right-of-way would not adversely affect existing land use; use of a corridor parallel to the existing right-of-way would cause minor, short-term land use impacts. When the project was completed, if DOE decided that the pipeline could not be used for other purposes, the pipeline would be removed and the land returned to its original condition.

4.2.8.4 Monitoring and Maintenance Impacts

Monitoring and maintenance of a disposal cell at the Klondike Flats site would not impose any land use impacts as long as the site remained under federal ownership and control. Monitoring locations such as wells that were required outside of DOE's property would impose minor land use impacts.

4.2.8.5 Impacts from All Sources

Short-term land use impacts would occur at the Moab site during construction and reclamation. Long-term impacts would result from ongoing ground water cleanup. Residual contamination at the site or on surrounding properties could create a need for short- to long-term access and restrictions in the form of institutional controls.

Long-term land use impacts would occur at the Klondike Flats site and for the permanent access road. The land use impacts created by the rail and slurry pipeline transportation options would be short term because the land needed for these transportation modes would be reclaimed and returned to BLM for prior designated land use. Of the total potential land use disturbance at Klondike Flats, approximately 420–435 acres for cell construction and up to 24 acres for dedicated access roads would remain under DOE ownership in perpetuity. DOE is deferring decisions regarding future uses and ownership of the 439-acre Moab site pending a determination of the success of remediation activities.

4.2.9 Cultural Resources

This section addresses the potential for disturbance of known cultural resources or the discovery of unknown resources associated with the Klondike Flats off-site disposal alternative.

4.2.9.1 Construction and Operations Impacts at the Moab Site

Under the Klondike Flats off-site disposal alternative, impacts to cultural resources from construction and operations at the Moab site would be the same as those described in Section 4.1.9.1.

4.2.9.2 Construction and Operations Impacts at the Klondike Flats Site

On the basis of current estimates (see Section 3.2.10), 15 to 19 cultural sites eligible for inclusion in the National Register of Historic Places could be adversely affected by construction and operations at the Klondike Flats disposal site. The Class III cultural resource survey that DOE would conduct at the Klondike Flats site would indicate the precise number and types of cultural sites present. Along with the Class III survey, DOE would conduct a site-specific study to

identify potential traditional cultural properties that may exist on the site (there is a low to medium likelihood that they would occur). DOE, BLM, the State Historic Preservation Officer, affected Native American tribes, and the Advisory Council on Historic Preservation would determine appropriate mitigation measures through the Section 106 consultation process (see Section 3.1.13.3). Mitigation measures might include (1) avoiding the cultural resource sites, (2) monitoring the cultural resource during surface-disturbing activities, (3) excavating and recording cultural resource data before construction activities began, or (4) moving cultural resource objects from areas of disturbance to nearby undisturbed areas.

Cultural resources located near areas of disturbance could be adversely affected indirectly (through illicit collection, vandalism, or inadvertent destruction) as a result of increased human activity in the area. DOE would require site workers to receive training on the need to protect cultural resources and the legal consequences of disturbing cultural resources.

4.2.9.3 Construction and Operations Impacts Related to Transportation

Under the truck transportation mode, one to four cultural sites (one site near the Moab site; up to three sites near the Klondike Flats site) eligible for inclusion in the National Register of Historic Places could be adversely affected by the construction of transportation infrastructure. Up to three cultural sites near the Klondike Flats site could be adversely affected under the rail alternative.

A total of 25 eligible cultural sites are known to exist within 0.5 mile of the proposed slurry pipeline to the Klondike Flats site. Of these, 6 to 20 could be adversely affected during pipeline construction. The potential for traditional cultural properties to occur along the pipeline route is medium to high. If these properties were located along the route, they most likely would be adversely affected as well. DOE, BLM, UDOT, the State Historic Preservation Officer, affected Native American tribes, and the Advisory Council on Historic Preservation would determine appropriate mitigation measures for these sites through the Section 106 consultation process.

In addition to these direct impacts, cultural resources located near the pipeline could be adversely affected indirectly through illicit collection, vandalism, or inadvertent destruction as a result of increased human activity in the area.

4.2.9.4 Monitoring and Maintenance Impacts

Impacts to cultural resources would not occur from monitoring and maintenance activities under the Klondike Flats disposal alternative.

4.2.9.5 Impacts from All Sources

Table 4–24 lists the total number of cultural sites eligible for inclusion in the National Register of Historic Places that could be adversely affected under each of the Klondike Flats site transportation options.

Table 4–24. Number of Cultural Sites That Could Be Adversely Affected Under the Three Transportation Options

Location/Activity	Transportation Mode		
	Truck	Rail	Slurry Pipeline
Moab site (construction and operations)	0–2	0–2	0–2
Moab site (highway improvements)	1	0	0
Klondike Flats site (including radon barrier borrow area and site access road)	15–19	15–19	15–19
Cover soil borrow area	0–11	0–11	0–11
Overpass and haul road for truck transport to Klondike Flats site	0–3	NA	0–1
Rail infrastructure at Klondike Flats site	NA	0–3	NA
Pipeline construction	NA	NA	6–20[a]
Total	**16–36**	**15–35**	**21–53[a]**

[a]Numbers do not include potential traditional cultural properties that have not yet been identified along the pipeline route; the likelihood of their occurrence is medium to high.

4.2.10 Noise and Vibration

This section addresses the impacts of noise and ground vibration primarily to human receptors. Where appropriate, impacts to wildlife and cultural resources are also identified. Unless indicated otherwise, all noise and vibration impacts would be temporary and would last only as long as project construction and operations were ongoing.

4.2.10.1 Construction and Operations Impacts at the Moab Site

Under this alternative, noise at the Moab site would come from construction activities and removal of the tailings pile. The largest sources of noise on the site would be heavy earth-moving equipment. The noise generated from these activities would not differ significantly from the noise generated at the Moab site under the on-site disposal alternative. See Section 4.1.10 for a description of the noise associated with construction and earth-moving activities.

For the rail transportation alternative, a conveyor system would be constructed to move the tailings uphill to the rail cars. This would represent an additional noise source. Estimates of noise from conveyor systems vary, but in general, the motor would be the most significant source of noise for a conveyor system. Diesel generators produce less than 80 dBA at a 23-ft reference distance (according to manufacturer specifications) when outfitted with mufflers and enclosures. The maximum level for a conveyor system of 90 dBA at 23 ft would attenuate to 65 dBA within 820 ft. The conveyor system would be located more than 980 ft from Arches National Park, and 1.1 miles from the nearest residence. The additional noise generated by a conveyor system would be indistinguishable relative to the noise generated by other construction equipment such as trucks and bulldozers.

Ground vibration generated by heavy equipment at the Moab site is discussed in Section 4.1.10. No appreciable differences would be expected in ground-level vibration between the on-site disposal alternative and the Klondike Flats off-site disposal alternative.

4.2.10.2 Construction and Operations Impacts at the Klondike Flats Site

Noise at the Klondike Flats site would come from construction activities and movement of the tailings. Regardless of the transportation method used, tailings disposal would require excavating soil and moving the tailings. Borrow materials brought in to cover the disposal cell would also be unloaded and moved. The most significant source of noise from these activities would be heavy equipment such as bulldozers and trucks. Similar to the analysis of the Moab site, a maximum noise level of 95 dBA (1-hour L_{eq}) was assumed to constitute a conservative estimate. This maximum noise level would attenuate to a level below the Moab 65-dBA residential noise standard within 1,480 ft. The only residence near the Klondike Flats site is the Canyonlands Field Airport, where four to seven people reside. This airport is located approximately 2,950 ft from the boundary of the Klondike Flats site and is outside the region of influence for noise.

Background levels of ground vibration range between 62 and 65 dBV. Ground vibration generated from equipment operations at the Klondike Flats site is estimated to have a maximum noise level of up to 95 dBV (Hanson et al. 1991). Ground vibration is estimated to follow a logarithmic decrease as distance from the source increases. Vibrations from a 95-dBV source should decrease to levels below human detection within 820 ft.

4.2.10.3 Construction and Operations Impacts Related to Transportation

Noise from transportation of material from the Moab site to the Klondike Flats site would originate from truck traffic, rail traffic, construction of temporary overpasses, or construction of a slurry pipeline. Truck traffic would occur along US-191 and access roads. Rail traffic would occur along existing rail lines and a new rail spur. Noise from construction of the slurry pipeline would occur along the pipeline corridor, which would run essentially parallel to US-191.

For truck transportation, the maximum hourly average of tailings haul truck traffic passing any point on US-191 between the Moab site and Klondike Flats site would be approximately 40 trucks. Current traffic along this stretch of highway produces a 1-hour L_{eq} of 73 dBA at 25 ft. Assuming attenuation from a line source and molecular absorption, there is a region of influence of 164 ft where noise levels exceed the 65-dBA Moab residential standard (Moab City Ordinance 17.74.080, "Noise Levels"). Assuming the project trucks were going 60 mph and generated 95 dBA at 25 ft from the source, the region of influence would increase by 260 ft to 426 ft. No permanent residences are within this region of influence along the transportation route. Noise generated along access roads should be less than along the highway because of the lower driving speed. No residences are within 0.6 mile of the proposed truck access roads.

For train transportation, the noise would be less than with truck transportation. The region of influence around the rail line that would exceed 65 dBA is estimated to be less than 330 ft. There are no residents within 330 ft of the existing rail line or the spur that would be added.

For slurry pipeline construction, a maximum noise level of 95 dBA is a conservative estimate. The region of influence around the construction site would be 1,480 ft. The location of the noise would move as construction progressed and would end once construction was complete.

There would also be short-term noise associated with the construction of access roads, temporary overpasses, the slurry pipeline, or a new rail spur. These sources of noise would be temporary and would occur more than 0.6 mile from the nearest residents at Canyonlands Field Airport.

Noise associated with these activities would attenuate to levels below 65 dBA before reaching the airport.

Ground vibration was considered only for the train and slurry pipeline alternatives, since rubber-wheeled vehicles such as trucks produce minimal amounts of ground vibration. Vibration from rail traffic could reach 90 dBV but would likely be less because of the slow travel speeds expected (10 to 30 mph, depending on grade and crossings). This level of ground vibration would attenuate to background levels within 660 ft of the source. No residents or sensitive receptors were identified within 660 ft of the existing rail line or the spur that would be added. Construction of a slurry pipeline would likely result in ground vibration above background levels within Arches National Park. The estimated maximum level for ground vibration produced during construction of a slurry pipeline would be 95 dBV. This level would result in ground vibration above background levels 820 ft from the source and levels above human perception within 330 ft of the source. Some cultural sites containing rock structures and the historic rock bridge at Arches National Park would be within 2,620 ft of the pipeline, but ground vibration levels would not reach levels (estimated to be 92 to 100 dBV) that would damage these structures.

4.2.10.4 Monitoring and Maintenance Impacts

Monitoring and maintenance of the Klondike Flats site would not be expected to result in significant generation of noise. Any noise generated by these activities would attenuate to near background levels before leaving the boundary of the disposal site.

4.2.10.5 Impacts from All Sources

Noise generated under the Klondike Flats off-site disposal alternative would not exceed the Moab residential noise standard of 65 dBA at any receptor locations. The receptors with the most potential to notice any increase in noise generated by this alternative would include the residences located on the eastern boundary of the Moab site and visitors at Arches National Park. If two 10-hour shifts were used instead of a single 12-hour shift, the noise generated would not change substantially, but there could be a higher potential for annoyance from late-night and early-morning activities.

4.2.11 Visual Resources

This section describes the impacts to the physical features of the landscape that impart scenic value in the region affected by the Klondike Flats off-site disposal alternative. The impacts would be imposed on viewers who live in, work in, or visit an area and can see ongoing human activities or the results of those activities.

4.2.11.1 Construction and Operations Impacts at the Moab Site

Construction and operations at the Moab site would have adverse impacts on visual resources during the construction period. During this period, the primary visual impacts would be associated with the noticeable movement of heavy equipment on the site as well as exhaust emissions and dust generated by the equipment. In an otherwise natural and still landscape, the movement and emissions of the heavy equipment would create a moderate contrast. Removal of the tailings pile, section by section, would increase the contrast between the pile and surrounding

landscape until the pile was completely removed. These moderate to strong contrasts would result from the increase in smooth horizontal and vertical lines associated with cuts into the pile. Dusk and dawn lighting (and nighttime lighting under a double-shift work scenario) would be noticeable from all the key observation points as well. The primary viewers of construction activities, the length of time the activities might be viewed, and potential mitigation measures are described in Section 4.1.11.1.

After the tailings were removed, the entire Moab site would be regraded and revegetated with native or adapted plant species. Until vegetation was established on the site (3 to 5 years), the 439 acres of smooth-textured, barren, red soil would contrast strongly with the more rugged, vegetated surroundings. In the long term, these contrasts would become negligible as the site developed a more natural, vegetated look. Scenic views of the Colorado River corridor, with its spectacular canyons and green riverbanks, would expand and become more prominent for travelers on US-191 and SR-279. Figure 4–9 shows a photo simulation of the Moab site after tailings removal and revegetation. Although the future use of the site is not known, removal of the pile and revegetation of the site would have strong positive visual impacts.

Figure 4–9. Simulated View of the Moab Site from Southbound Lane of US-191 After Tailings Pile Removal

4.2.11.2 Construction and Operations Impacts at the Klondike Flats Site

Construction and operations at the Klondike Flats site would have minor adverse effects on visual resources, primarily because construction activities and the completed disposal cell would not be seen by most people. DOE selected four key observation points from which to assess visual impacts: (1) US-191 southbound, (2) US-191 northbound, (3) Blue Hills Road, and

(4) Arches National Park. Figure 4–10 and Figure 4–11 show DOE's visibility analysis results for two potential locations for the Klondike Flats disposal cell—one in Section 35 of T. 23 S., R. 19 E. (Figure 4–10) and one in Section 25 of the same township (Figure 4–11). The darkened areas indicate locations from which a disposal cell could potentially be viewed. The visibility analysis used to create this map is based on elevation and topography. It does not take into account the potential obstruction of views from cultural modifications or vegetation, or the effects of distance on visibility. Without visual aids, such as binoculars, most people would not be able to recognize a disposal cell at distances greater than 5 to 10 miles.

The visibility analysis results for both cell-location scenarios indicate that travelers on US-191, Blue Hills Road, and most areas within Arches National Park would not be able to view the Klondike Flats disposal cell. The one potential adverse impact from cell construction at these key observation points would be from the lighting used during dawn and dusk hours (and at nighttime under the double-shift work scenario) during the construction period. This impact would be expected to be minor, as shielded night lighting would be used to minimize glare. No lighting would remain at the site once the cell was completed.

Figure 4–10 indicates that the disposal cell would be in a viewer's line of sight from the I-70 scenic overlook and the Windows View area in Arches National Park. DOE visited both of these locations and determined that both were too distant from the Klondike Flats site for a cell to be discernible. In both figures, the darkened areas within a 10-mile radius of the Klondike Flats site are in remote locations that generally would not be accessible by vehicle. The only group that would likely view construction activities and the completed disposal cell from these remote locations would be persons recreating in the area.

DOE's proposed action at the Klondike Flats site would be compatible with BLM's Class III visual resource objectives for this area, as the Class III designation allows an activity to attract, but not dominate, the attention of casual observers (BLM 2003). Construction activities and the completed disposal cell would not be seen by the general public.

4.2.11.3 Construction and Operations Impacts Related to Transportation

Truck Haul

Under the truck haul option, the newly constructed US-191 overpass and access road to the Klondike Flats site would be visible to travelers on US-191 and Blue Hills Road, respectively. These features, however, would not draw the attention of most travelers; they are common features in the modern, culturally modified landscape, and travelers would expect to see these kinds of features. Once the disposal cell was completed, the overpass and a portion (about a 2-mile section) of the access road would be removed and reclaimed. After 3 to 5 years of vegetation growth, the former locations of these features would not be apparent.

The number of trucks per hour that would use US-191 and the haul road adjacent to Blue Hills Road on any given day to transport materials (tailings, borrow material, and vicinity property material) would vary, probably significantly, depending on the phase of operation and other factors during the approximately 3 to 5 years (depending on work shift scenario) during which construction and transportation activities would be ongoing (Figure 2–1). Table H–7 reports a total of approximately 331,000 material shipments, which would represent approximately 662,000 one-way trips, conservatively assuming that all shipments consisted of two legs.

A single 12-hour work shift ongoing for 5 years (350 days/year) and a double 10-hour work shift ongoing for 3 years both represent 21,000 work hours. Thus, on average, regardless of the work shift scenario, DOE estimates that it would require approximately 32 trucks per hour using US-191 and the haul road adjacent to Blue Hills Road to transport all materials. This increase in truck traffic may or may not be noticed by travelers on US-191, which already is a primary trucking route. Because truck traffic is currently pervasive on US-191, the visual impacts of the potential additional traffic would be negligible for US-191 travelers. For travelers on Blue Hills Road, between US-191 and the turn-off to the disposal cell site, the addition of 32 trucks per hour would have adverse visual impacts. In an isolated, somewhat desolate, desert setting, the additional truck traffic would create moderate to strong contrasts (depending upon the amount of motorized recreational traffic present) in movement and would draw attention to the project. These impacts would be short term (3 to 5 years) only.

For the general public, this transportation option would be compatible with BLM's Class III visual resource objectives. For a relatively small number of recreationists who travel Blue Hills Road, this transportation option would not be compatible with Class III objectives during the 3- to 5-year period of disposal cell construction.

Rail Haul

Under the rail haul option, the newly constructed railroad spur would be visible to travelers on US-191 and Blue Hills Road. As under the truck haul option, this feature would not draw the attention of most travelers, as it is a feature commonly found along highways. The train/truck transfer station that would be constructed under this option would draw the attention of recreationists traveling Blue Hills Road. The station would not be visible to travelers on US-191. The station's buildings and rotary dump—characterized by bold, angular, smooth surfaces—would create a strong contrast with the surrounding natural landscape, which is characterized by smooth, flat desert plains, horizontal mesa tops, and sparsely scattered vegetation The movement of haul trucks between the rotary dump and disposal cell site would also create moderate to strong contrast, depending upon the amount of motorized recreational traffic present. These adverse impacts would occur throughout the construction period. Once the disposal cell was completed, haul truck traffic would cease, the station would be dismantled, and the station area would be reclaimed with native vegetation. After 3 to 5 years of vegetation growth, the visual impact would be eliminated. Because of the strong visual contrast the station and truck traffic would create for travelers on Blue Hills Road, this transportation option would not be compatible with BLM's Class III visual resource objectives during the construction period. However, Class III objectives would be met once the station was dismantled.

Slurry Pipeline

Under the slurry pipeline option, adverse visual resource impacts would occur during pipeline construction and for approximately 3 to 5 years afterward, during revegetation of the corridor. After construction of the disposal cell was completed, the pipeline would be removed, again disturbing the land and creating adverse visual impacts. The primary viewers of the pipeline corridor would be travelers on US-191, as the corridor would be visible from the highway along most of its length (with the exception of a 4-mile stretch that parallels historic US-160). In Moab Canyon, the smooth, linear, unvegetated swath created by pipeline construction would contrast moderately with the surrounding features, some of which are linear and barren of vegetation (US-191, historic US-160, railroad grade) and some of which are complex, rugged, or vegetated

(canyon walls, sagebrush-covered hills). After vegetation was established along the corridor, the contrast would be weak or nonexistent. The visual impacts associated with construction of the pipeline would not be compatible with BLM's Class II objectives in Moab Canyon. To meet Class II objectives, the level of change to the existing landscape would have to be low, could not attract the attention of a casual observer, and should repeat the basic elements of line, form, color, and texture that are found in the predominant natural features. Class II objectives would be met once the corridor became revegetated, after approximately 3 to 5 years.

North of Moab Canyon, the pipeline route would cross terrain that is designated Class III and Class IV by BLM. In these areas, the smooth, linear, unvegetated swath created by pipeline construction would contrast moderately with the surrounding features, characterized primarily by light-beige and light-gray, rolling desert plains and smooth, rounded, buff-colored bluffs. After vegetation was established along the corridor, the contrast between the corridor and surrounding landscape would be moderate to nonexistent, depending upon the success of revegetation. Figure 4–12 shows a view from US-191 of an existing pipeline corridor 5 years after construction. DOE's proposed pipeline would parallel this corridor. The visual impacts associated with construction and revegetation of the pipeline would be compatible with BLM's Class III and IV objectives.

Figure 4–12. View of 5-Year-Old Pipeline Corridor from US-191, Approximately 2 Miles South of Blue Hills Road Turnoff

4.2.11.4 Monitoring and Maintenance Impacts

Impacts to visual resources would not occur from monitoring and maintenance activities under the Klondike Flats disposal alternative.

4.2.11.5 Impacts from All Sources

Moving the tailings pile from the Moab site to the Klondike Flats site under any transportation option would have short-term, adverse visual impacts and negligible to no long-term adverse visual impacts, primarily because the short-term construction activities and the completed disposal cell would not be seen by most people. At the Moab site, removal of the pile would have strong beneficial impacts to visual resources. Table 4–25 summarizes visual resource impacts that would be expected under this alternative.

Table 4–25. Summary of Visual Resource Impacts Under the Klondike Flats Off-Site Disposal Alternative

Location/Activity	Visual Resource Impacts	
	Short Term	Long Term
Moab site	Strong adverse impacts primarily to travelers on US-191 and SR-279	Strong positive impacts from removal of tailings pile
Klondike Flats disposal cell site	Negligible to no adverse impacts; site not visible to most casual observers	Negligible to no adverse impacts; site not visible to most casual observers
Cover soil borrow area	Negligible to strong adverse impacts, depending upon borrow source	No adverse impacts
Truck haul[a]	Negligible adverse impacts to US-191 travelers; moderate to strong adverse impacts to Blue Hill Road travelers	No adverse impacts
Rail haul[a]	Negligible adverse impacts to US-191 travelers; strong adverse impacts to Blue Hills Road travelers	No adverse impacts
Slurry pipeline[a]	Moderate adverse impacts to travelers on US-191	Moderate to no adverse impacts to travelers on US-191
Monitoring and maintenance	No adverse impacts	No adverse impacts

[a]Only one transportation option would be selected.

4.2.12 Infrastructure

This section addresses potential impacts on the availability of electric power, potable water, nonpotable water, sewage treatment, rail service, and highways. Unless indicated otherwise, all infrastructure impacts would be temporary and would last only as long as project construction and operations were ongoing.

4.2.12.1 Construction and Operations Impacts at the Moab Site

The basic 600-kVA power demand at the Moab site discussed for the on-site disposal alternative would also apply at the Moab site under all three off-site disposal alternatives. In addition, the rail and slurry pipeline options would result in additional power demands. For truck transportation, the total power demand would be 600 kVA, the same as for the on-site disposal alternative. Rail transportation would require an additional 100 kVA of demand, for a total demand of 700 kVA. Slurry pipeline transportation would require an additional 2,800 kVA, for a total demand of 3,400 kVA. ESC Inc. developed and reviewed this projected demand with Mathew Yates, Pacific Corporation, Moab. Pacific Corporation indicated that this demand would

present no capacity problems to the existing electric supply system at the site, nor would system upgrades be required (ESC 2003).

The estimated average daily potable water consumption would differ for the three possible modes of transportation. Assuming the more aggressive double 10-hour work schedule, these demands would be approximately 11,000 gallons per day for slurry pipeline transportation, 12,500 gallons per day for rail transportation, and 15,000 gallons per day for truck transportation.[1] The City of Moab has indicated that these demands could be met without adversely affecting the city's water supply or requiring system upgrades (Swenson 2003).

The estimated average annual nonpotable water demand impact would differ for the three possible modes of transportation. Assuming the more aggressive double 10-hour schedule for rail and truck transportation, these demands would be approximately 120 acre-feet per year for both rail and truck transportation.[2] For the slurry pipeline mode of transportation, DOE assumes that all 730 acre-feet per year shown in Table 2−24 would come from the Colorado River at the Moab site, although DOE recognizes that some nonpotable makeup water from the off-site disposal sites would be used if necessary. As noted in Section 4.1.12.1, DOE is authorized to withdraw approximately 3 cfs (2,366 acre-feet per year) from the Colorado River for consumptive use and an equal amount for nonconsumptive use. The highest potential demand of 730 acre-feet per year (pipeline transportation) converts to approximately 1.0 cfs, or one-third of DOE's annual authorized consumptive withdrawal volume.

The proposed new rail sidings and rail infrastructure would neither enhance nor detract from the rail infrastructure currently servicing the area and would be removed upon completion of the project. The proposed new acceleration and deceleration lanes and overpasses would neither enhance nor detract from the road infrastructure currently servicing the area; they, too, would be removed upon completion of the project.

Sanitary waste impacts would be the same as those described for the Moab site in Section 4.1.12.1.

4.2.12.2 Construction and Operations Impacts at the Klondike Flats Site

Power demands for construction and operations at the Klondike Flats site would be qualitatively similar to but quantitatively less than those for the Moab site. The impact on the existing electrical infrastructure servicing the Klondike Flats site area would differ for the three alternative modes of transportation. For truck transportation, the total power demand would be 300 kVA; for rail transportation, the total power demand would be 600 kVA; and for slurry pipeline transportation, the total power demand would be 2,500 kVA. ESC of Fort Collins, Colorado, developed and reviewed this projected demand with Mathew Yates, Pacific Corporation (Utah Power and Light), Moab. The capacity of the existing electrical distribution system circuit would support the additional demands for the truck or rail haul options. However,

[1]In Table 2−25, the data shown assume the less aggressive single 12-hour work schedule; the estimates above assume the more aggressive double 10-hour schedule. Further, data in the table show collective consumption at the Moab site, an off-site cell location, and transportation-related usages. For estimating usage at different locations, DOE assumed that half the usage shown in the table would be at the Moab site and half at the off-site disposal site.

[2]In Table 2−24 (Nonpotable Water Consumption), the data show collective consumption at the Moab site, the off-site cell location, and transportation-related usages. For estimating usage at the Moab site only, DOE assumed 50 percent of the collective 235 to 240 acre-feet/year usage for rail or truck transport shown in the table, or approximately 120 acre-feet per year.

the electrical demands of the slurry pipeline option would require a distribution circuit upgrade from Utah Power's Seven Mile substation, which is located about 6 miles south at the intersection of SR 191 and SR 313, or an upgrade of the Bookcliffs substation, which is located about 12 miles north in Crescent Junction. If the slurry pipeline option were implemented, the selection of the substation for upgrading would be based on a full utility engineering evaluation at the time of construction (ESC 2003).

The potable water demand at the Klondike Flats site would be the same as the demand at the Moab site (Section 4.1.12.1). That is, assuming the more aggressive double 10-hour work schedule, potable water demands would be approximately 5,500 gallons per day for slurry pipeline transportation, 6,250 gallons per day for rail transportation, and 7,500 gallons per day for truck transportation. These demands would not adversely affect the city water supply system.

The nonpotable water demands for Klondike Flats site would be the same as the demand at the Moab site (Section 4.1.12.1). All of the nonpotable water would come from the Colorado River. For the truck and rail transportation modes, DOE assumes that approximately half of the total demand for nonpotable water would be consumed at the off-site disposal site.

Activities at the Klondike Flats site would generate 5,000 to 11,000 gallons of sanitary waste per week, depending on the transportation mode. This would be in addition to the 10,000 gallons per week generated at the Moab site. The waste would be stored in portable toilets and septic tanks and transported for treatment at the City of Moab sewage treatment plant. The total 15,000 to 21,000 gallons of sanitary waste per week would not exceed the city's current excess capacity (see Section 4.1.12.1); however, the same 9,000-gallon-per-day restrictions for wastes from septic tanks and portable toilets described in Section 4.1.12.1 would also apply.

4.2.12.3 Construction and Operations Impacts Related to Transportation

The proposed new rail sidings and rail infrastructure and the proposed acceleration and deceleration lanes and overpasses would neither enhance nor detract from the rail and road infrastructure currently servicing the area and would be removed upon project completion. Truck traffic transporting contaminated materials or borrow area material to the Klondike Flats site or the Moab site would result in increased wear and tear on local roads and on US-191. However, UDOT has indicated that the additional trucks resulting from the truck haul option could be accommodated with current highway design and planned improvements (UDOT 2002). The cost to the State from wear and tear on roads would be offset through vehicle registration and special permit fees, both of which provide revenue to the state general highway fund for road maintenance and repair. Transportation plans would include provisions for enforcing speed limits, road load limits, and any other applicable traffic laws.

The proposed 100 tons of cargo per railcar is currently the National Association of Railroads average cargo weight per car, and neither this load weight nor the proposed 30 cars per train would pose any track use restrictions. However, the proposed increase in train frequency (four to eight round trips per day compared to the current one round trip per week) would require increased track inspections and maintenance and possible speed restrictions in specific areas due to increased wear and tear on the track and crossings. The required increased maintenance costs would be built into the rate quotes for the shipments. The increased volume of traffic may require crossing gates at specific crossings. A decision regarding crossing gates would be made

jointly by UDOT, Grand County, and the railroad, based on final determinations of train frequency and schedules (Legg 2003).

Overall site power requirements under the Klondike Flats off-site disposal alternative, including those for transportation-related operations, are presented in Chapter 2.0. The truck transportation mode would not entail additional power demands over the 300 kVA required for site construction and operations. However, the rail transportation mode would draw an additional 300 kVA (600 kVA total demand), and the slurry pump would draw an additional 2,200 kVA (2,500 kVA total demand).

4.2.12.4 Monitoring and Maintenance Impacts

Monitoring and maintenance activities would be generally limited to periodic inspections and activities to remedy incipient erosion. DOE expects that these activities would not affect the local or regional infrastructures.

4.2.12.5 Impacts from All Sources

At the Moab site, the maximum power demand of 3,400 kVA (slurry pipeline transportation option) could be met with no impact to Utah Power's existing electric supply infrastructure servicing the site. At the Klondike Flats site, the power demands of the rail and truck transportation options could be met with no impact to Utah Power's existing electric supply infrastructure servicing the area, but the 2,500-kVA demand of the slurry pipeline option would require a distribution circuit upgrade at Utah Power's Bookcliff or Seven Mile substation. At the Moab site and the Klondike Flats site, the maximum potable water demand of 7,500 gallons per day for both locations (truck transport option) could be met with no adverse impact to the City of Moab's existing potable water supply infrastructure. At the Moab site and the Klondike Flats site, the combined maximum nonpotable water demand of 730 acre-feet per year (slurry pipeline transportation option) would be approximately one-third of DOE's existing Colorado River water usage rights at the Moab site. Sanitary waste impacts at the Moab site and Klondike Flats site would be the same as those described for the Moab site in Section 4.1.12.5. Shipments of vicinity property material and borrow material to the Moab and Klondike Flats sites would result in wear and tear on state and county roads. In addition, implementation of the truck transportation option would result in further road wear and tear. Truck permit and registration fees would compensate Utah and Grand County for this unavoidable adverse impact to the road infrastructure. If the rail transportation option were implemented, there would be increased wear and tear on the Cane Creek Branch rail line and the need to schedule more frequent track and rail bed inspections, maintenance, and repair. Shipping fees paid to Union Pacific Railroad would compensate the railroad for this unavoidable adverse impact to the rail infrastructure.

4.2.13 Solid Waste Management

This section discusses impacts from generation of solid waste under this alternative. These wastes would be generated for the duration of remedial action. Contaminated solid wastes generated at the site would be disposed of in the tailings pile. The impacts of construction and operations at the Moab site under the Klondike Flats disposal alternative would be the same as those described in Section 4.1.13.1 with the exception that RRM from ground water treatment would be generated for an estimated 75 rather than 80 years.

4.2.13.1 Construction and Operations Impacts at the Klondike Flats Site

Activities at the Klondike Flats site would generate approximately 1,040 yd^3 of uncontaminated solid waste, which would be disposed of at the Grand County landfill, with the same impacts as the on-site disposal alternative (see Section 4.1.13.1).

4.2.13.2 Construction and Operations Impacts Related to Transportation

Small volumes of uncontaminated solid waste would be generated during transportation of contaminated materials. These wastes would be disposed of in the Grand County landfill.

4.2.13.3 Monitoring and Maintenance Impacts

Very small volumes of waste would be generated as a result of ongoing inspections and monitoring. All wastes would be managed in accordance with applicable laws and regulations.

4.2.13.4 Impacts from All Sources

Management of an estimated 1,040 yd^3 of solid wastes generated as a result of the Klondike Flats off-site disposal alternative would not result in adverse environmental or waste disposal capacity impacts. Sixty-six hundred tons of RMM would be generated annually for 75 years if an evaporation-based ground water remediation treatment were implemented. These wastes would be handled, recycled, or disposed of according to approved waste management plans and applicable state and federal regulations.

4.2.14 Socioeconomics

This section discusses potential socioeconomic impacts for the off-site disposal alternative at the Klondike Flats site. The aggregate impacts would depend on the mode of transportation used: truck, rail, or slurry pipeline. These impacts are examined using geographically and industrially detailed information on expected direct and indirect changes in output, earnings, and employment over the construction and transportation phases of the project. The analysis also considers potential impacts from increased demand for temporary housing, and the short-term and long-term influence of the surface remediation on the regional tax base and future economic development opportunities.

As discussed in Section 4.1.14, the affected socioeconomic region of influence covers Grand County and San Juan County in southeastern Utah. The impact analysis uses project cost and workforce information specific to actions undertaken for the off-site disposal alternative (summarized in Section 4.1.14, Table 4–8). On the basis of this information, economic impacts in the two-county socioeconomic region of influence are evaluated using RIMS II regional multipliers obtained from the Bureau of Economic Analysis, U.S. Department of Commerce (BEA 1997) (described in Section 4.1.14). The industries expected to be initially affected by the project include the regional construction and transportation industries, along with supporting service industries (especially hotels and restaurants). The project workforce is assumed to come from outside the socioeconomic region of influence and to spend a portion of their earnings on housing, food, and other goods and services within the two-county socioeconomic region of influence.

The economic impacts for the off-site disposal alternative at the Klondike Flats site are summarized in Table 4–26. The annual project cost under the truck transport option is estimated to be $41,287,950 over an 8-year disposal period, followed by estimated annual costs of $933,000 during the 75-year period of active ground water remediation/site monitoring. Annual costs under the rail transport option are estimated to be $48,978,463 over the 8-year disposal period, followed by $933,000 over the ground water remediation/site monitoring period. The slurry pipeline transport option is expected to have annual costs of $49,401,688 over the disposal period, and $933,000 over the ground water/site remediation period. Project expenditures over the 8-year disposal period would result in changes in the output of goods and services, labor earnings, and employment levels, particularly in the regional construction/transportation industries. Under the truck transport option, the regional output of goods and services would increase by $54,563,048 a year over the 8-year disposal period. Under the rail transport or slurry pipeline options, annual output of goods and services would increase by $64,697,605 and $65,255,331, respectively. The new spending would also increase labor earnings and employment. Under the truck option, earnings and employment would rise by $13,418,584 and 391 direct and indirect jobs. The increase in labor earnings and employment would be $15,918,000 and 315 direct and indirect jobs under the rail transport option. Increased regional earnings under the slurry pipeline option would initially rise to $16,055,548 and 335 jobs during the first-year construction phase of the pipeline. Thereafter, earnings and employment would scale down to $15,097,007 and 315 jobs. The annual expenditures during ground water remediation and site monitoring of $933,000 would not produce significant impacts on the output of goods and services, labor earnings, or employment levels in the two-county socioeconomic region of influence.

Table 4–26. Economic Impacts in the Two-County Socioeconomic Region of Influence Under the Klondike Flats Off-Site Disposal Alternative

Transport Method	Annual Cost	Annual Output of Goods and Services	Annual Labor Earnings	Jobs
Truck	$41,287,950	$54,563,048	$13,418,584	391
Rail	$48,978,463	$64,697,605	$15,918,000	315
Pipeline	$49,401,688	$65,255,331	Year 1 $16,055,548	335
			Years 2–8 15,097,007	315

Note: Economic impacts for regional output of goods and services and labor earnings are calculated based on final-demand multipliers provided by the Bureau of Economic Analysis. The respective multiplier values (1.3178 and 0.3250) are multiplied by annualized cost to generate the impact values shown. Employment impacts are calculated as the product of the direct-effects multiplier (1.4262) and total direct jobs for each action alternative (see Tables 2–16, 2–17, and 2–18).

The potential shorter-term impacts under the Klondike Flats off-site disposal alternative would include increased demand for temporary housing (discussed in Section 4.1.14) and transportation-related inconveniences to motorists (discussed in Section 4.2.16). The extent of these shorter-term impacts would depend on levels of tourism-recreation activities and the mode of transportation used in the remediation process. Longer-term beneficial impacts from remediation at the Moab site would relate to greater opportunities for economic development in the Moab area and greater diversification of the tax base (discussed in Section 4.1.14).

4.2.15 Human Health

This section addresses potential impacts to human health. These impacts are worker deaths that could occur as a result of industrial accidents and worker or public latent cancer fatalities that

could occur as a result of exposure to radiation from activities at the Moab and Klondike Flats sites, at vicinity properties, or during transportation of materials.

4.2.15.1 Construction and Operations Impacts at the Moab Site and Klondike Flats Site

Under the Klondike Flats off-site disposal alternative, construction activities would occur at the Moab site, vicinity properties, borrow areas, and the Klondike Flats site. Table 4–27 lists the impacts from these activities. For each transportation option under this alternative, less than one fatality would be estimated to occur from construction activities.

Table 4–27. Construction-Related Fatalities Under the Klondike Flats Off-Site Disposal Alternative

Alternative	Construction Fatalities
Truck Option	
Vicinity properties	0.031
Borrow areas	0.042
Moab and Klondike Flats activities	0.31
Total	**0.38**
Rail Option	
Vicinity properties	0.031
Borrow areas	0.037
Moab and Klondike Flats activities	0.32
Total	**0.39**
Slurry Pipeline Option	
Vicinity properties	0.031
Borrow areas	0.042
Moab and Klondike Flats activities	0.36
Total	**0.43**

Workers. Under the Klondike Flats disposal alternative, workers would be exposed to radon gas (an inhalation hazard) and external radiation from the mill tailings at the Moab site, vicinity properties, and the Klondike Flats site. According to results of monitoring data collected during construction of an evaporation pond on the tailings pile, the highest radon level measured on the pile was 0.096 working levels (21 pCi/L). A worker exposed to this level of radon for 2,000 hours per year would have a latent cancer fatality risk of 6.1×10^{-4} per year of exposure. The highest external gamma exposure rate measured on the tailings pile was about 0.60 mR/h. A worker exposed to this level of radiation for 2,000 hours per year would have a latent cancer fatality risk of 6.0×10^{-4} per year of exposure. The total latent cancer fatality risk to the worker on the tailings pile would be 1.2×10^{-3} per year of exposure (Table 4–28), or 6.0×10^{-3} over the 5-year duration of activities at the Moab site. Assuming that the radon and external gamma radiation levels were comparable at Klondike Flats, this would also be the latent fatality risk at Klondike Flats.

Table 4–28. Worker Impacts Under the Klondike Flats Off-Site Disposal Alternative

Worker	Site	Radon Related LCFs[a,b]	External Radiation-Related LCFs[a,b]	Total LCFs[a,b]
Annual				
Individual	Moab	6.1×10^{-4}	6.0×10^{-4}	1.2×10^{-3}
	Klondike Flats	6.1×10^{-4}	6.0×10^{-4}	1.2×10^{-3}
	Vicinity properties	2.9×10^{-4}	1.2×10^{-4}	4.1×10^{-4}
Population	Moab	0.041	0.040	0.081
	Klondike Flats	0.043	0.042	0.085
	Vicinity properties	6.7×10^{-3}	2.9×10^{-3}	9.6×10^{-3}
	Total	**0.091**	**0.085**	**0.18**
5-Year Duration of Activities				
Individual	Moab	3.0×10^{-3}	3.0×10^{-3}	6.0×10^{-3}
	Klondike Flats	3.0×10^{-3}	3.0×10^{-3}	6.0×10^{-3}
	Vicinity properties	8.7×10^{-4}	3.7×10^{-4}	1.2×10^{-3}
Population	Moab	0.20	0.20	0.40
	Klondike Flats	0.21	0.21	0.42
	Vicinity properties	0.020	8.6×10^{-3}	0.029
	Total	**0.43**	**0.42**	**0.85**

[a]Based on 67 workers at the Moab site, 70 workers at the Klondike Flats site, and 23 workers at vicinity property sites.
[b]LCF = latent cancer fatality

At the Moab site, there would be 67 workers. Assuming that they were all exposed to radon and external radiation at the levels discussed for individual workers, the latent cancer fatality risk for this population of workers would be 0.081 per year of exposure or 0.40 over the 5-year duration of activities at the Moab site. At the Klondike Flats site, there would be 70 workers. Assuming that they were all exposed to radon and external radiation at the levels discussed for individual workers, the latent cancer fatality risk for this population of workers would be 0.085 per year of exposure or 0.42 over the 5-year duration of activities at Klondike Flats.

Impacts to workers as a result of activities at the vicinity properties would be the same as those under the on-site disposal alternative, as would be the lack of impacts from ground water treatment; these impacts are described in Section 4.1.15.2.

Public. Under the Klondike Flats off-site disposal alternative, nearby residents would be exposed to radon gas released at the Moab site and at Klondike Flats. The average radium-226 content of the tailings, 516 pCi/g, would produce a latent cancer fatality risk for a maximally exposed individual (nearby resident) in Moab of 8.8×10^{-3} over the 5-year duration of activities at the Moab site and 1.8×10^{-5} over the 5-year duration of activities at Klondike Flats. These estimates include radon released from the drying areas at the Moab site. If a slurry pipeline were used to move the tailings to Klondike Flats, the drying areas would not be necessary, and the resulting latent cancer fatality risk for a nearby resident at Moab would be reduced to 6.9×10^{-3} over the 5-year duration of activities at the Moab site.

For the population, over the 5 years of activities at Klondike Flats, the latent cancer fatality risk to the population surrounding Klondike Flats would be 0.011. Over the 5 years of activities at the Moab site, the latent cancer fatality risk to the population surrounding the Moab site would be

1.0. If a slurry pipeline were used to move the tailings to the Klondike Flats site, the drying areas would not be necessary, and the resulting latent cancer fatality risk for the population surrounding the Moab site would be reduced to 0.74 over the 5-year duration of activities at the Moab site.

Nearby residents would also be exposed to radioactive particulates (e.g., radium-226, polonium-210, thorium-230, and uranium) blown off the site from the Moab site and at Klondike Flats. Estimates based on monitoring data collected during 1998 and 1999 from the Monticello, Utah, mill tailings site when uranium mill tailings were being excavated indicate that the latent cancer fatality risk from radioactive particulates would be about 0.1 percent of the risk from radon emissions from the Moab site and Klondike Flats. This is due to the aggressive dust suppression practices that would be used to minimize emissions of radioactive particulates.

4.2.15.2 Construction and Operations Impacts Related to Transportation

Under the Klondike Flats disposal alternative, there would be a total of 330,926 shipments if trucks were used to move the tailings from the Moab site to Klondike Flats (Table 4–29). If rail were used, there would be a total of 68,154 shipments. If a slurry pipeline were used to move the tailings, there would be 64,314 shipments. These shipments would include contaminated material from vicinity properties, uranium mill tailings, and borrow material, which would consist of cover soils, radon and infiltration barrier soils, sand and gravel, riprap, and Moab site reclamation soils.

Table 4–29. Shipments Under the Klondike Flats Off-Site Disposal Alternative

Material	Truck Option		Rail Option		Slurry Pipeline Option	
	Shipments	Mode	Shipments	Mode	Shipments	Mode
Vicinity property material	2,940	Truck	2,940	Truck	2,940	Truck
Borrow material	59,186	Truck	59,186	Truck	59,186	Truck
Uranium mill tailings	268,800	Truck	3,840 2,188	Rail[a] Truck	2,188	Truck
Total	**330,926**		**68,154**		**64,314**	

[a]Each rail shipment would consist of 30 railcars of uranium mill tailings.

The transportation impacts of shipping contaminated materials from vicinity properties, mill tailings, and borrow material would be from two sources: radiological impacts and nonradiological impacts. Radiological impacts would be from incident-free transportation and from transportation accidents that released contaminated material. There would be no radiological impacts from moving borrow material because it is not contaminated. Nonradiological impacts would be from engine pollutants (emissions from the truck or train moving the contaminated materials from vicinity properties, mill tailings, and the borrow material) and from traffic fatalities. The total transportation impacts would be the sum of the radiological and nonradiological impacts. Additional details on these analyses are provided in Appendix H.

Table 4–30 lists the transportation impacts under the Klondike Flats off-site disposal alternative. For this alternative, there would less than one fatality. In comparison, about 40,000 traffic fatalities occur annually in the United States (U.S. Census Bureau 2000) and about 335 occur annually in Utah (DOT 2004).

Table 4–30. Transportation Impacts Under the Klondike Flats Off-Site Disposal Alternative

Alternative	Radiological			Nonradiological		Total Fatalities
	Incident-Free		Accident Risk LCFs	Pollution Health Effects Fatalities	Traffic Fatalities	
	Public LCFs	Worker LCFs				
Truck Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	9.3×10^{-4}	0.081	0.082
Mill tailings	1.6×10^{-3}	0.010	2.0×10^{-9}	9.6×10^{-5}	0.26	0.27
Total	**1.6×10^{-3}**	**0.010**	**8.9×10^{-9}**	**1.4×10^{-3}**	**0.34**	**0.35**
Rail Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	9.3×10^{-4}	0.081	0.082
Mill tailings	1.6×10^{-5}	1.6×10^{-3}	3.5×10^{-9}	6.1×10^{-5}	0.15	0.15
Total	**4.3×10^{-5}**	**1.6×10^{-3}**	**1.0×10^{-8}**	**1.4×10^{-3}**	**0.23**	**0.23**
Slurry Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	9.3×10^{-4}	0.081	0.082
Mill tailings	1.3×10^{-5}	8.4×10^{-5}	1.6×10^{-11}	7.8×10^{-7}	2.1×10^{-3}	2.2×10^{-3}
Total	**4.0×10^{-5}**	**1.2×10^{-4}**	**6.9×10^{-9}**	**1.3×10^{-3}**	**0.084**	**0.086**

Workers. For truck shipments of mill tailings from the Moab site to Klondike Flats, the maximally exposed transportation worker would be the truck driver. This person was assumed to drive the truck containing mill tailings for 1,000 hours per year. For the other 1,000 hours per year, the truck would be empty. This driver would receive a radiation dose of 220 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 1.1×10^{-4}.

For rail shipments of mill tailings from the Moab site to Klondike Flats, the maximally exposed transportation worker would be an individual who inspects the loading of the rail cars. This person would receive a radiation dose of 440 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 2.2×10^{-4}.

Public. For truck shipments of mill tailings from the Moab site to Klondike Flats, the maximally exposed member of the public would be a resident who lived along the road on which the tailings were shipped. This person would receive a radiation dose of 1.0 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 6.3×10^{-7}.

For rail shipments of mill tailings from the Moab site to Klondike Flats, the maximally exposed member of the public would be a resident who lived along the rail line on which the tailings were shipped. This person would receive a radiation dose of 0.53 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 3.2×10^{-7}.

Accidents. If trucks were used to transport the mill tailings from the Moab site to Klondike Flats, the maximally exposed individual would receive a radiation dose of 0.16 mrem or 1.6×10^{-4} rem from the maximum dose reasonably foreseeable for a transportation accident involving a shipment of mill tailings. This is equivalent to a probability of a latent cancer fatality of about 9.6×10^{-8}. The probability of this accident is about 0.06 per year.

If this accident occurred near Moab, the population would receive a collective radiation dose of 1.8×10^{-3} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.1×10^{-6}. If this accident occurred in a rural area, the population would receive a collective radiation dose of 2.9×10^{-6} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.7×10^{-9}.

If rail were used to transport the mill tailings from the Moab site to Klondike Flats, the maximally exposed individual would receive a radiation dose of 1.4 mrem or 1.4×10^{-3} rem from the maximum dose reasonably foreseeable for a transportation accident involving a shipment of mill tailings. This is equivalent to a probability of a latent cancer fatality of about 8.5×10^{-7}. The probability of this accident is about 0.3 per year.

If this accident occurred near Moab, the population would receive a collective radiation dose of 0.017 person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.0×10^{-5}. If this accident occurred in a rural area, the population would receive a collective radiation dose of 2.7×10^{-5} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.6×10^{-8}.

4.2.15.3 Monitoring and Maintenance Impacts

Monitoring and maintenance activities would include checking water quality and installing a long-term ground water remediation system at the Moab site, and conducting periodic maintenance and inspections of the Klondike Flats site (checking for erosion, damaged fencing, etc.). None of these activities would be expected to breach the cap over the tailings; installation of the Moab site ground water system would be done in clean areas after remediation was complete. Data from another UMTRCA site indicate that the Klondike Flats off-site disposal alternative would be effective in isolating the contaminants in the tailings from individuals conducting activities on the site. DOE (2001) concluded that both radon and gamma levels associated with the capped-in-place tailings pile at the Shiprock site in New Mexico were indistinguishable from naturally occurring radiation levels. Therefore, the latent cancer fatality risk to workers conducting monitoring and maintenance would be comparable to the risk from background levels of radioactivity in Utah, about 3×10^{-4} per year of exposure.

4.2.15.4 Impacts from All Sources

Under the Klondike Flats off-site disposal alternative, less than one fatality would be estimated to occur from construction activities under any of the transportation options. Transportation of contaminated materials from the Moab site to the Klondike Flats site would result in the exposure of workers and the public to very small amounts of radiation; these exposures would not be expected to result in any latent cancer fatalities to any population. Ammonia releases from ground water remediation would be well below threshold concentrations for human health effects.

Based on as-built radon flux measurements from completed uranium mill tailings disposal cells constructed under both Title I (federal UMTRA Project sites) and Title II (private licensees) of UMTRCA, it is anticipated that actual radon flux would be two orders of magnitude less than the 20-pCi/m^2-s EPA protective standard promulgated in 40 CFR 192. However, even though DOE's experience supports a conclusion that radon release rates from the capped pile would be negligible and that DOE's long-term monitoring and maintenance of the site would ensure cap integrity, for the purpose of supporting analyses of long-term performance and impacts, DOE has also assessed impacts assuming the maximum allowable release rate of radon, 20 pCi/m^2-s, under EPA's regulations (40 CFR 192).

Based on this emission rate and the dimensions of the disposal cell, the latent cancer fatality risk for a nearby resident would be 1.5×10^{-7} per year of exposure, or 4.4×10^{-6} over the 30-year period following the end of construction and operations. This latent cancer fatality risk is less than the risk from background levels of radioactivity in Utah, about 3×10^{-4} per year of exposure.

For the population near the Klondike Flats site, the latent cancer fatality risk would be 2.8×10^{-3} over the 30-year period following the end of construction and operations.

At the Moab site, radon emissions would fall to background levels because the mill tailings pile would have been relocated. The latent cancer fatality risk would be comparable to the risk from background levels of radioactivity in Utah, about 3×10^{-3} per year of exposure.

The design life of the disposal cell for the uranium mill tailings is 200 to 1,000 years. Over this period of time, the amount of radioactivity in the disposal cell will decrease slightly, less than 1 percent, due to the half lives of the radionuclides contained in the uranium mill tailings. In the time frame of 200 to 1,000 years, the major route of exposure of people would be through the inhalation of radon progeny from the disposal cell. There is no surface water pathway at the Klondike Flats site. The uppermost aquifer at the Klondike Flats site is 400 to 500 ft below the surface, and the travel time to the uppermost aquifer is over 25,000 years, so it is unlikely that ground water would contribute large latent cancer fatality risks relative to inhalation of radon progeny. With the disposal cell cover in place and the Klondike Flats site being under perpetual care, it is likely that the latent cancer fatality risk for an inadvertent intruder would also be low.

After the disposal cell cover was installed, the estimated annual latent cancer fatality risk from radon for a nearby Klondike Flats resident would be 1.5×10^{-7}. As with the radioactivity in the disposal cell, the annual risk would also not decrease appreciably over the 200- to 1,000-year time frame. Therefore, the annual latent cancer fatality risk for a nearby Klondike Flats resident would be about the same immediately after the cover was installed as it would be 1,000 years after the cover was installed. This assumes that the nearby resident remains at his or her present location. If the resident were to move closer to the disposal cell, the annual latent cancer fatality risk would be similar to the risk at the Moab Site, 8.9×10^{-5} per year of exposure.

Based on the 20-pCi/m^2-s radon release rate, for the population within a 50-mile radius of the Klondike Flats site, the annual latent cancer fatality risk was estimated to be 9.3×10^{-5}. As with the radioactivity in the disposal cell, the annual risk would also not decrease appreciably over the 200- to 1,000-year time frame. If it is assumed that the population around the Klondike Flats site remains constant over 1,000 years, then the estimated latent cancer fatality risk over the 1,000-year time period would be 0.09.

4.2.16 Traffic

This section summarizes potential impacts to traffic in the area affected by the Klondike Flats disposal alternative. In the following discussions, estimated percent increases in traffic are based on increases over the 2001 AADT for all vehicles or for trucks on segments of US-191 or I-70 published by UDOT (see Table 3–15).

Implementation of this alternative would increase area traffic as a result of construction and operations at the Moab site, remediation of vicinity properties, transport of tailings from the Moab site to the Klondike Flats site, and transport of borrow materials from borrow areas to the Moab site, vicinity properties, and the Klondike Flats site.

There would be initial minor short-term (period of several months) increases in area traffic on US-191 while preparations took place at the Moab site and at the Klondike Flats site. These activities would include bringing heavy equipment such as backhoes, graders, front-end loaders, bulldozers, and trucks to the sites; and constructing secure stockpile areas for various materials to be used during the remedial action (e.g., diesel fuel, water for dust control). In addition, a variety of construction trades would need to access the sites to set up temporary field offices and prepare road access areas. These activities would add to area traffic and could result in minor congestion and inconveniences near the site entrances on US-191.

Construction workers would commute to the Moab site for jobs at the site, at vicinity properties, and at borrow areas. DOE estimates that the average annual number of vehicle trips associated with these workers could increase daily traffic in central Moab by an estimated 380 vehicle trips per day on US-191 (calculated from Table 2–16). Transportation-related workers would also commute to jobs. DOE estimates that the vehicle trips associated with these workers could increase daily traffic on US-191 by 168 vehicle trips per day (truck transportation option) (calculated from Table 2–16). If all workers traveled through central Moab to access their work location, an estimated 548 new vehicle trips per day would result in an estimated 3-percent increase in traffic in central Moab. (The rail and pipeline transportation modes would also result in a 3-percent increase in traffic in downtown Moab from commuters). The current traffic situation in Moab is reported by UDOT as highly congested, and these additional vehicle trips would exacerbate the current congestion problem. Miscellaneous trips for supplies and meals would also add to traffic congestion. However, this estimate is based on a worst-case analysis that assumes the maximum number of transportation workers (truck option) and that all workers would need to traverse central Moab to access the Moab and Klondike Flats sites. It is more likely that some workers, possibly one-half of the work force, would come from cities north of Moab, such as Green River, Utah, or Grand Junction, Colorado, and that some workers would car-pool. In addition, assuming a double work shift, approximately half of these trips would occur before 7:00 a.m. and just after 4:00 a.m., times of the day when traffic volumes are typically lower. The short-term (estimated 6 months) impact that would be associated with the 250 pipeline construction workers under the pipeline option was not considered a worst-case scenario.

Transporting contaminated vicinity property material and associated backfill material to the Moab site would require up to 48 daily truck trips on local roads and US-191, some or most of which would transit central Moab (Section 2.1.2.2). Assuming the worst-case traffic scenario of a double work shift, transporting all contaminated material from the Moab site to the Klondike Flats site would require an estimated 768 daily tandem truck trips (Table 2–9) on US-191, none

of which would transit central Moab. This would increase existing levels of all traffic on US-191 between the Moab site and Klondike Flats by 29 percent, or an estimated 95-percent increase in truck traffic on US-191. Using truck transportation under this alternative would almost double truck use of US-191 from the existing use; however, this increase would be distributed evenly over the 20 hours per day that work would be ongoing under a double-shift work schedule.

Trucks carrying borrow material would originate from borrow sources north and south of the Klondike Flats site. All of these trips would occur on segments of US-191. North of Moab, truck traffic would increase by 116 trucks per day, or a 14-percent increase in truck traffic on US-191 north of the disposal site. A portion of these materials would continue to the Moab site to be used for site restoration. Because the destination of these trucks would be the Klondike Flats site or the Moab site, traffic in central Moab would not be affected. However, an estimated nine truck trips carrying borrow materials from south of Moab would also occur. These trips are not considered further, as their impact would be minor compared to existing traffic levels of 16,045 in central Moab.

In addition to use of US-191, borrow material shipments coming from the Floy Wash borrow area would also need to use I-70. As shown in Table 3−15, the existing AADT on I-70 west of Crescent Junction is 7,040 vehicles of all types. Assuming all cover and Moab site reclamation soils came from Floy Wash, the addition of 116 trips per day would result in a 2-percent increase over current AADT volumes on 1-70. Truck volume on I-70 would increase from 1,126 trucks to 1,246 heavy trucks per day, a 10-percent increase. I-70 in this area is not considered congested by UDOT and does not currently carry large volumes of traffic.

Although there would be sustained increases in the AADT on US-191, project components would include an overpass to access the upgraded disposal site road (Blue Hills Road) and acceleration and deceleration lanes that would alleviate safety concerns related to use of US-191 by recreational and commercial truck traffic. It is anticipated that upgrading US-191 from two to four lanes between SR-313 and the Moab site would be completed prior to the start of this project.

Rail transport would also require the transport of borrow materials as described above (116 truck trips per day related to transport of borrow materials from borrow areas north of Moab, and 9 trips per day related to transport of borrow sources south of Moab). It would also require 2–5 truck trips per day to haul contaminated debris that could not be carried by rail. This additional truck traffic on US-191 would not be noticeable.

Rail transport would require between 8 and 16 daily train trips to carry contaminated materials between the Moab site and Klondike Flats site, which would occur 6 days a week. One to two trains per hour would travel past intersecting county or state roads, which would result in vehicle delays of 2 to 3 minutes at the various railroad crossings. These delays would affect primarily SR-313, Gemini Bridges, Blue Hills Road, and other county roads used for backcountry access. There would be potential safety concerns over motorists waiting at the intersection of Blue Hills Road and US-191 for the railroad crossing to clear. Blue Hills Road provides access to heavily used backcountry areas.

A slurry pipeline would also require limited transport of materials by truck. Transport of oversized materials that could not be transported by pipeline would result in additional minor use of trucks on US-191 (about six trucks per day). In addition, borrow materials would be transported as described under the truck transportation option.

Annual monitoring and maintenance activities at the site would result in no increases in traffic volumes.

4.2.17 Disposal Cell Failure from Natural Phenomena

It is possible that a disposal cell failure could occur at the Klondike Flats site. The possibility of failure at this site would be much lower than at the Moab site because it was selected for analysis, in part, to avoid the more dynamic characteristics of the Moab site (see Chapter 3.0). The Klondike Flats site is not located near a river, does not have historical seismic activity, and is not prone to settling. In addition, this site is located farther away from populated areas or sensitive habitats than the Moab site, which would reduce the potential risks if a disposal cell failure occurred. Therefore, the possibility of a failure occurring and resulting in potential risks at the Klondike Flats site would be much lower than the potential risks of a disposal cell failure at the Moab site. For this reason, a potential failure at this site was not evaluated.

4.2.18 Environmental Justice

The basis for DOE's analysis of environmental justice impacts is described in Section 4.1.18. One census block area with a reported annual household income of less than $18,244 (poverty level for a family of four) is found about 30 miles north of the site. Although this population could be exposed to small doses of radiation as a result of activities under this alternative, there is no evidence that it would be exposed at a level any higher than the general population. Although traffic in central Moab would be an adverse impact, it does not appear that minority or low-income populations would suffer disproportionately.

DOE has identified no high and adverse impacts, and no minority or low-income populations would be disproportionately affected by the implementation of the Klondike Flats disposal alternative.

4.3 Off-Site Disposal (Crescent Junction Site)

This section discusses the short-term and long-term impacts associated with the second of three off-site disposal alternatives. The Crescent Junction site is located approximately 31 miles north of the Moab site and approximately 13 miles north of the Klondike Flats site. The impacts are based on the proposed actions described in Section 2.2, and the affected environment described in Section 3.3, of this EIS. This alternative may result in the following impacts:

- Impacts at the Moab site
- Impacts at the Crescent Junction site
- Transportation impacts associated with moving tailings from the Moab site to the Crescent Junction site
- Monitoring and maintenance impacts at the Crescent Junction site

The combined impacts that may result from these activities are summarized for each assessment area (e.g., Geology and Soils) at the end of each subsection. For many activities, impacts at the Moab site would not differ significantly from those described in Section 4.2 for Klondike Flats. Likewise, construction and operation impacts at the Crescent Junction site, as well as monitoring and maintenance impacts, would be similar to those addressed for the Klondike Flats site.